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(54) A CARRIER MATRIX FOR A CATALYTIC REACTOR FOR CLEANING EXHAUST GASES OF INTERNAL COMBUSTION ENGINES

(57) In one form, the matrix comprises a plurality of superposed plates, alternate plates being corrugated to space the plates. In another form two plates, one of which is corrugated are wound together to form a cylindrical roll. At least one of the plates has projecting tangs which engage in associated depressions or holes in an adjacent plate to prevent relative lateral displacement between the plates. In another embodiment, a single corrugated sheet is wound into a roll, tangs 18 pressed out of the plane of the sheet engaging in depressions 16 formed under tangs of the adjacent layer of the winding.

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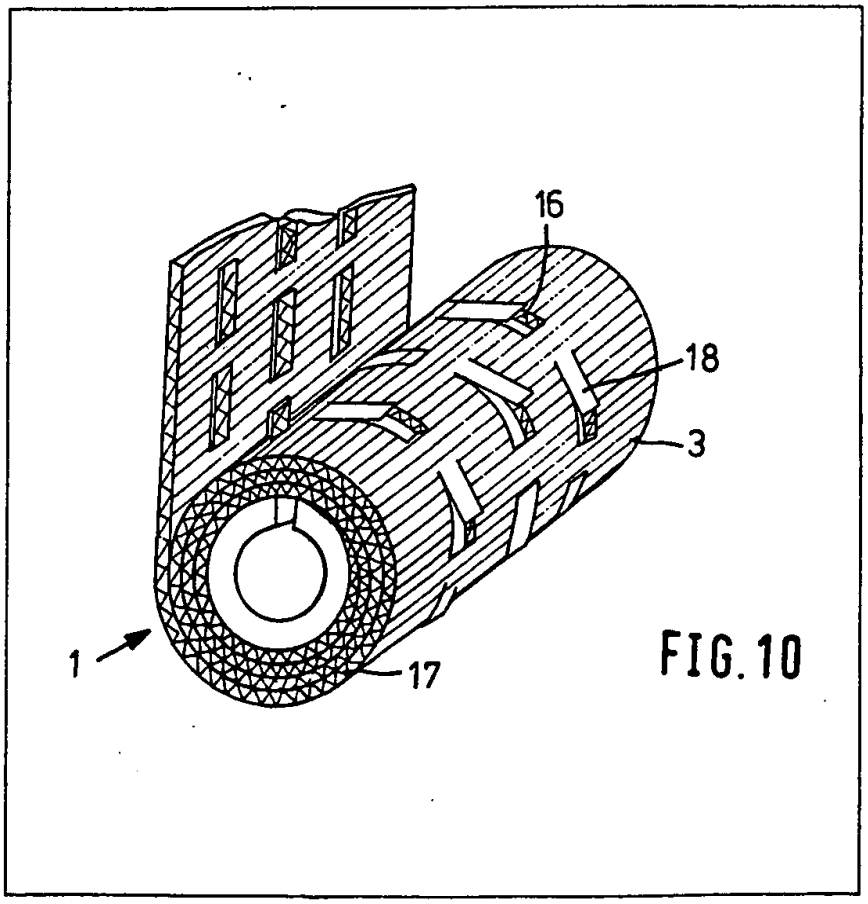

FIG. 10

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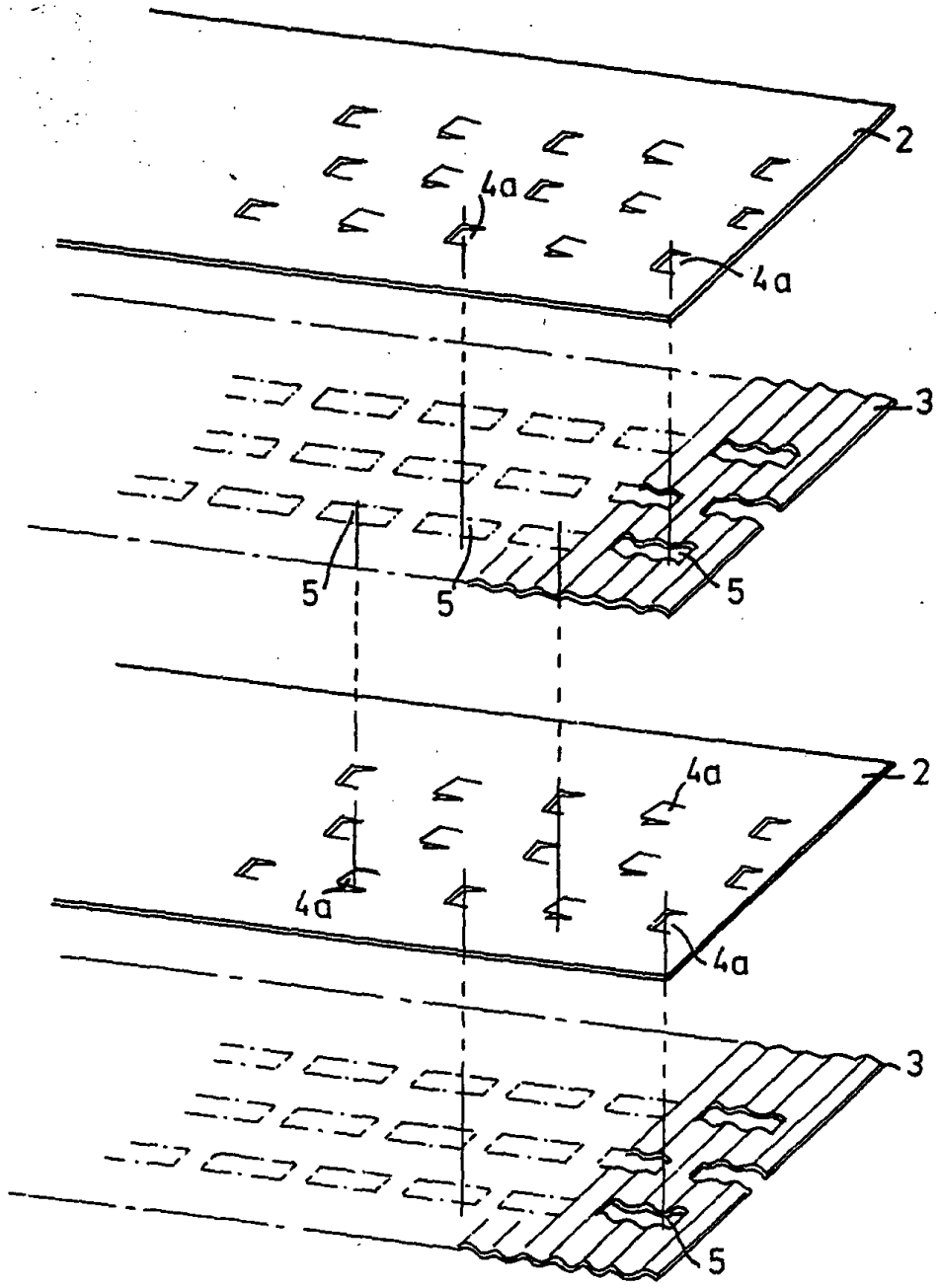

FIG. 1

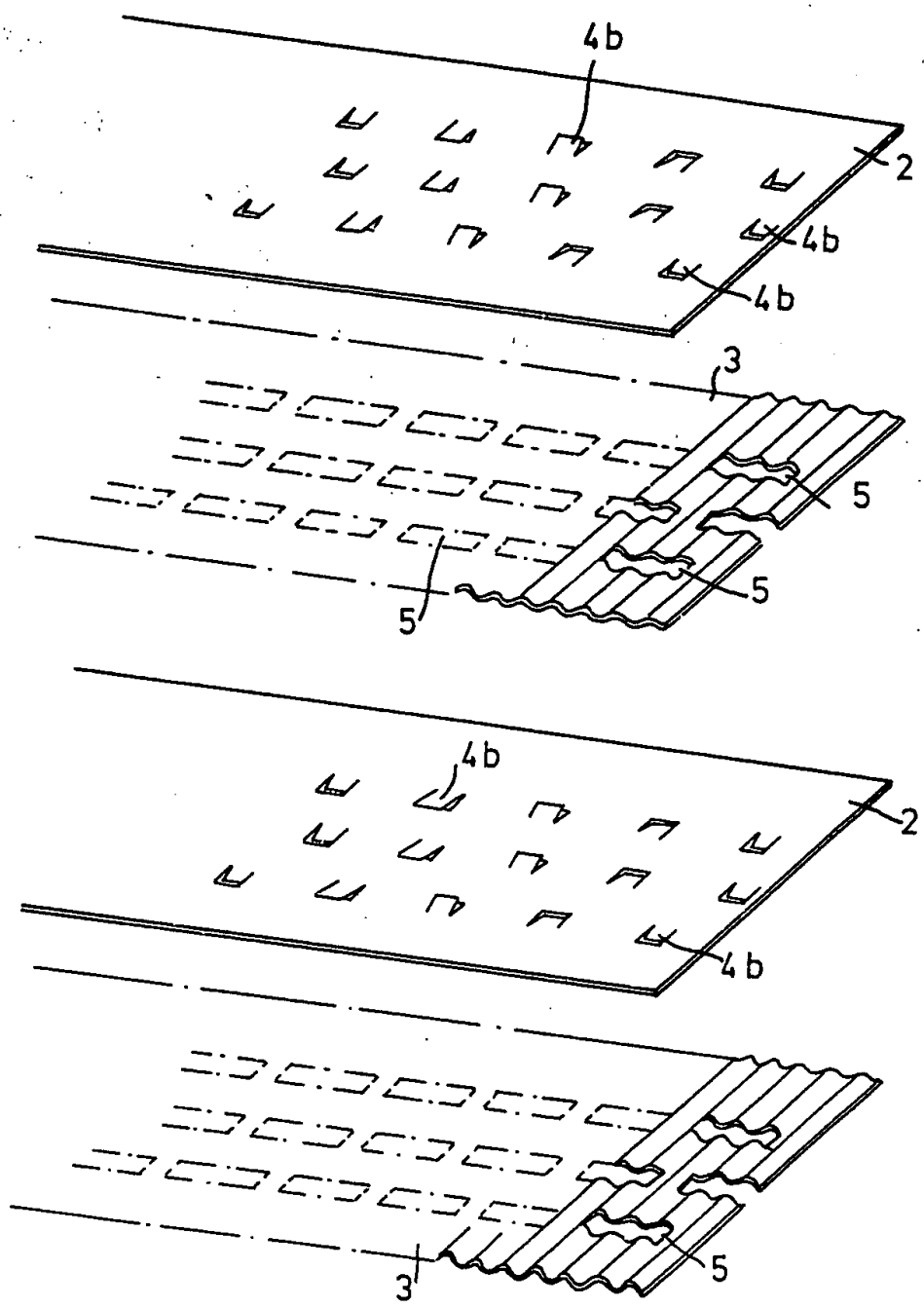

FIG. 2

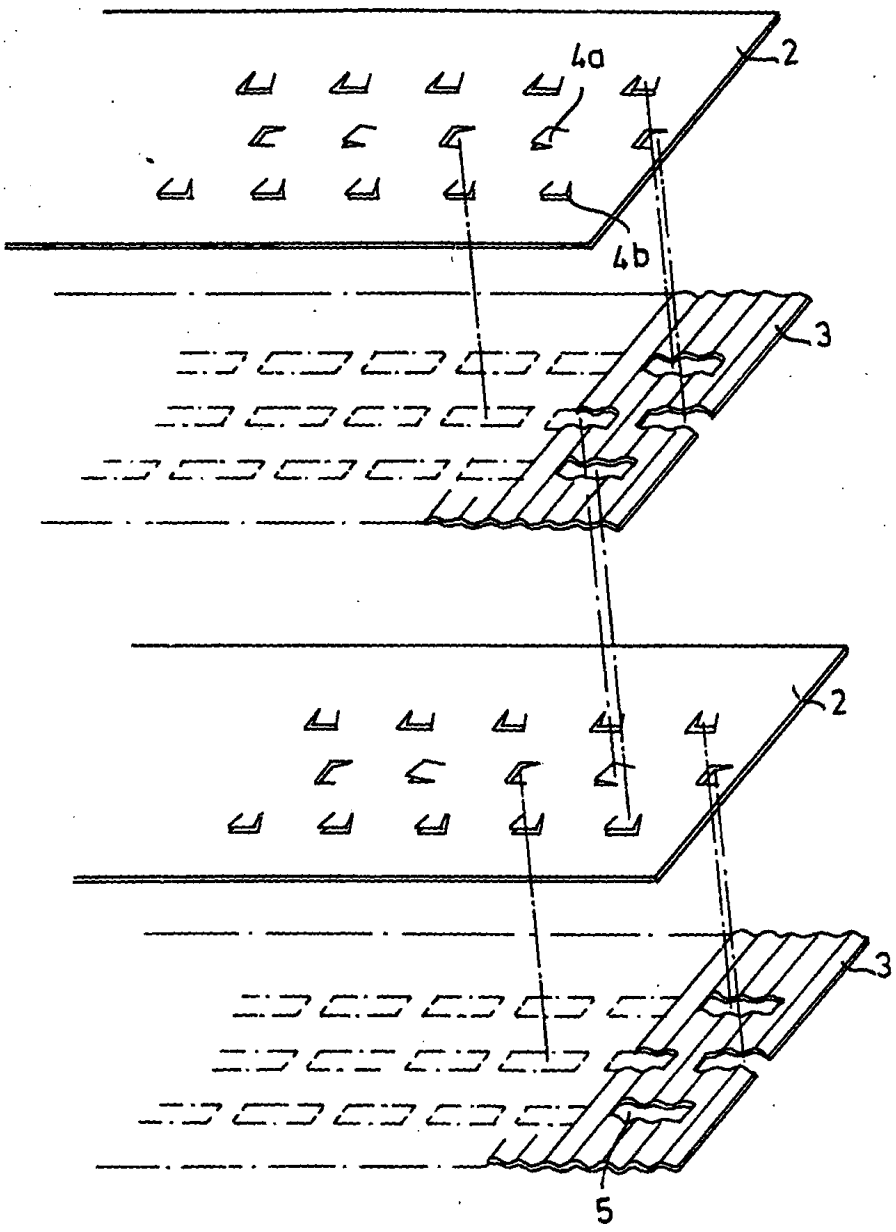

FIG.3

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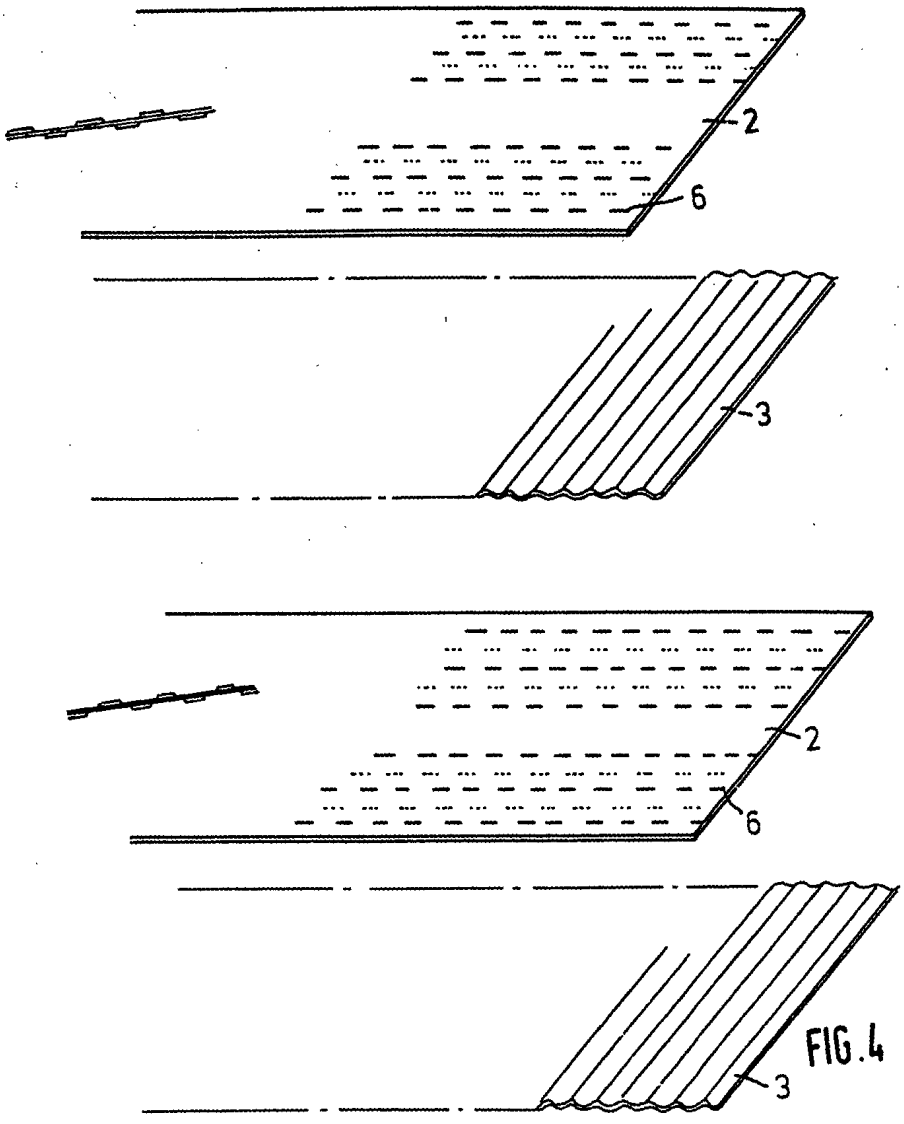

FIG.4

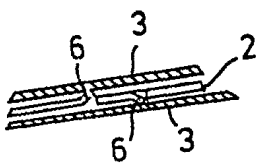

FIG.5

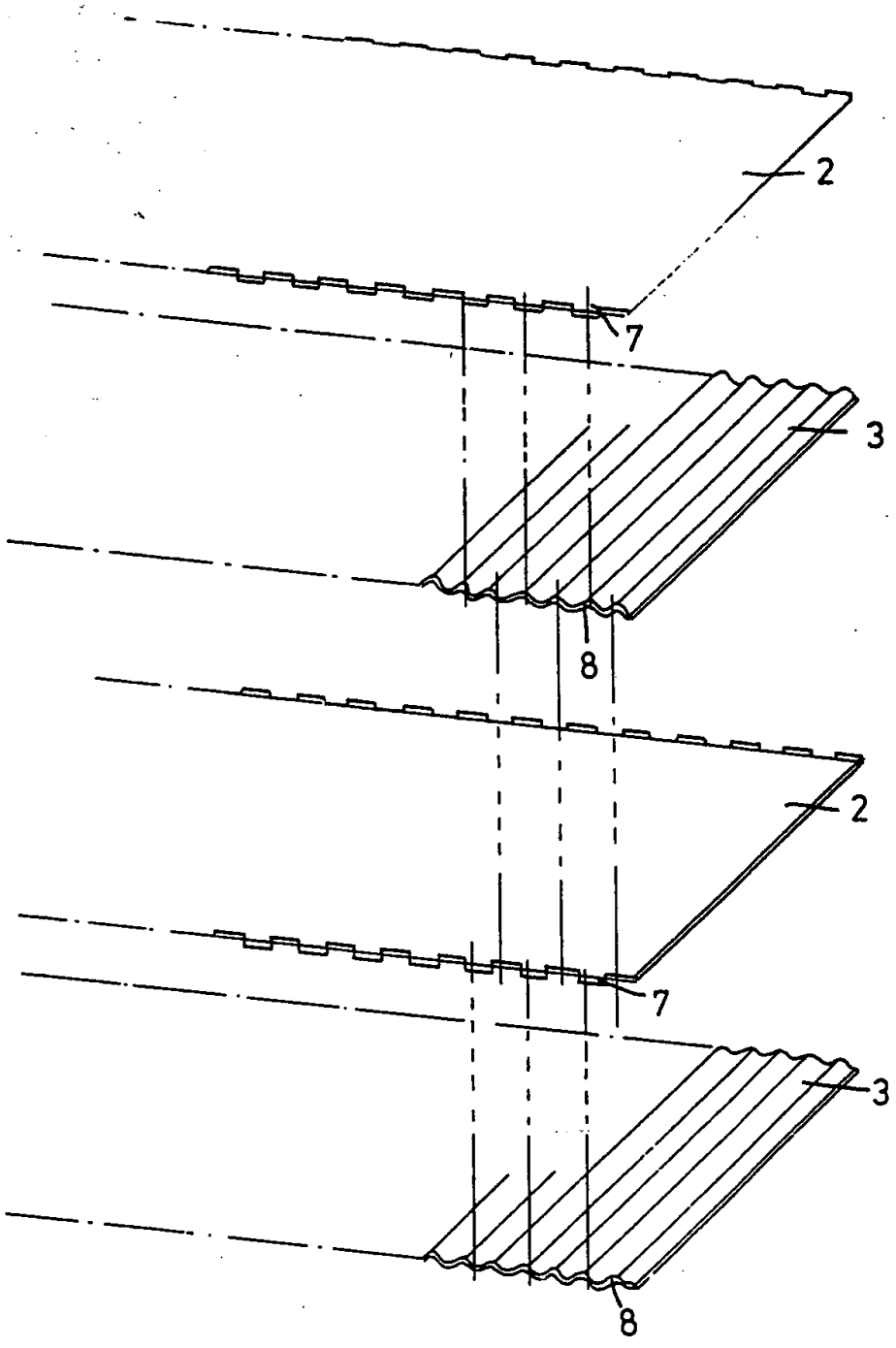

FIG. 6

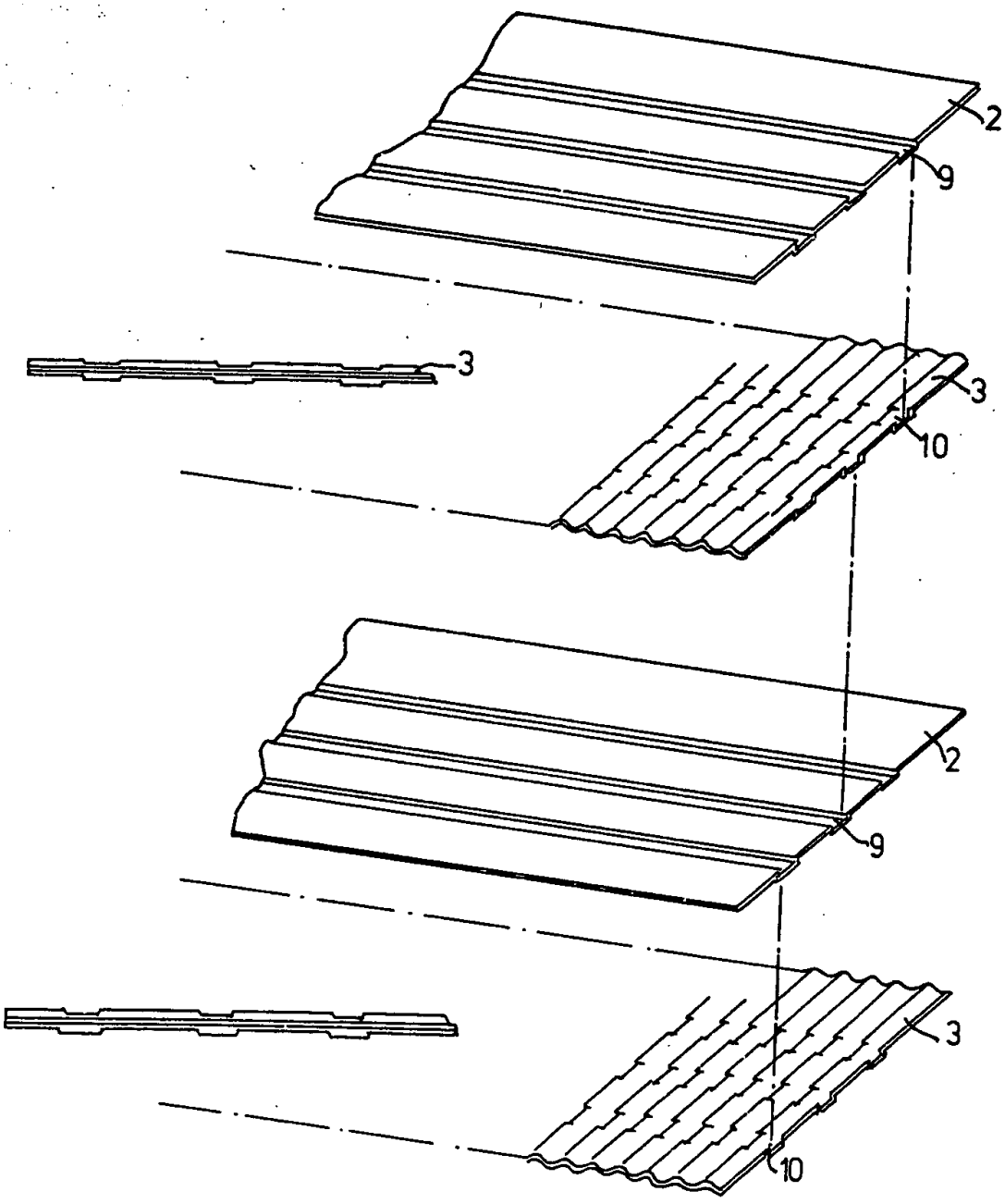

FIG. 7

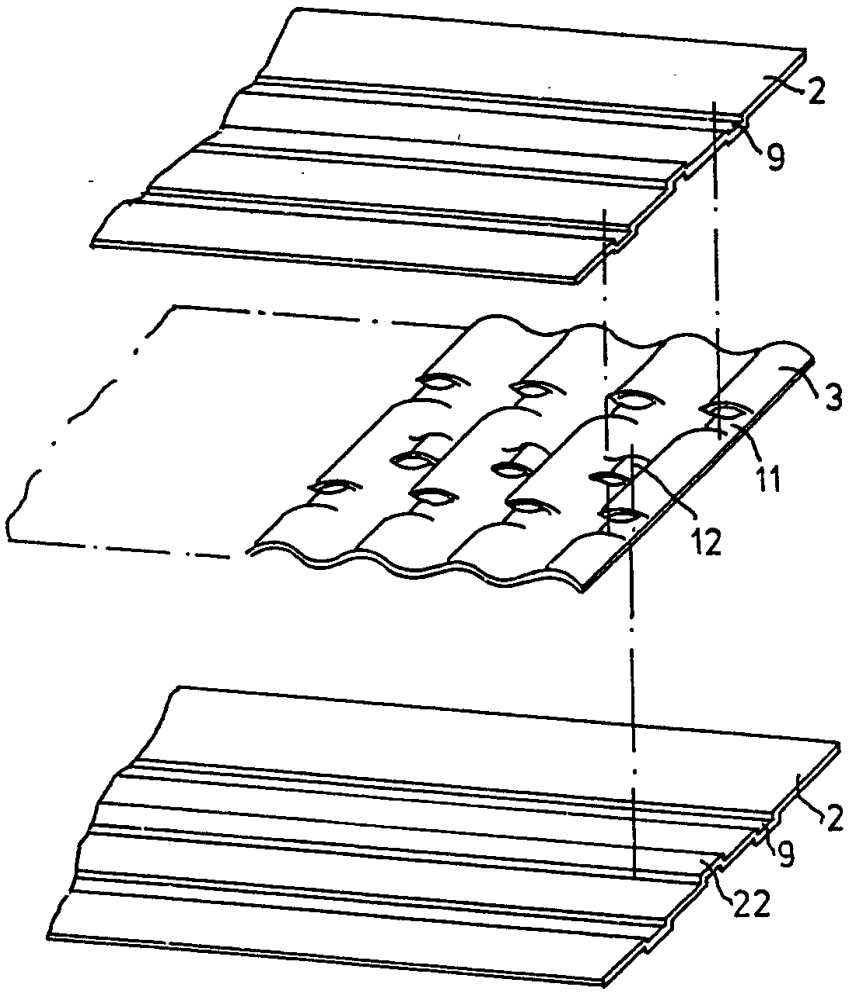

FIG. 8

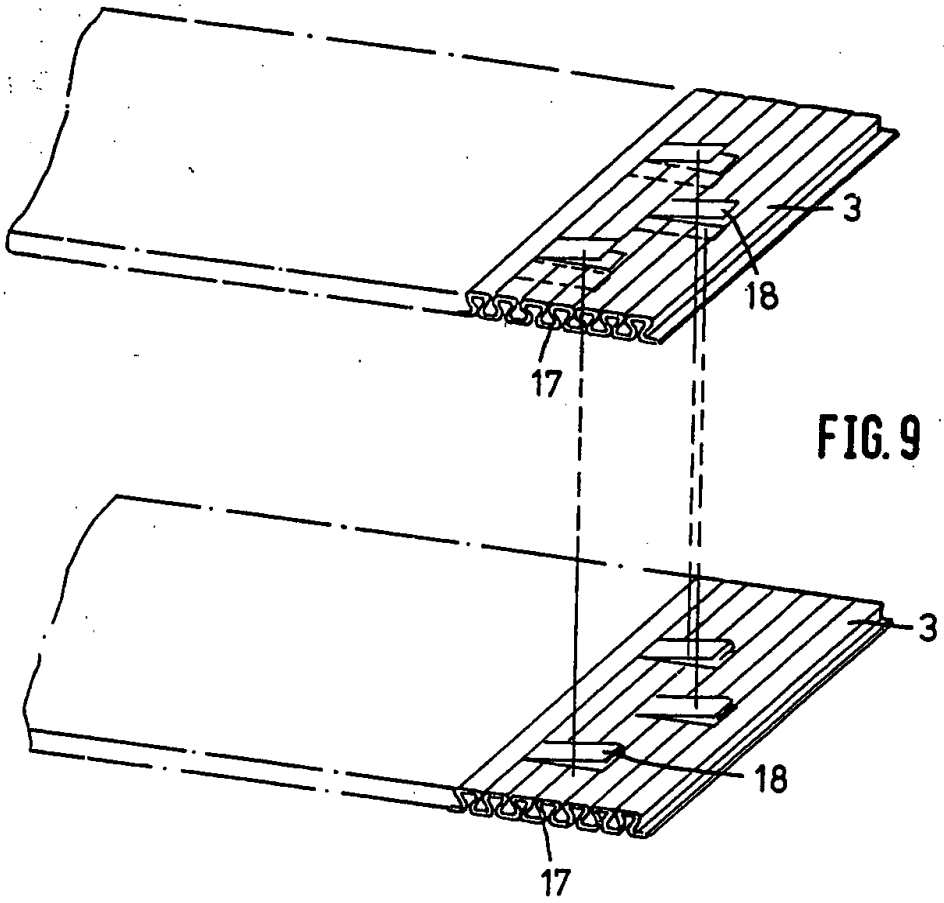

FIG.9

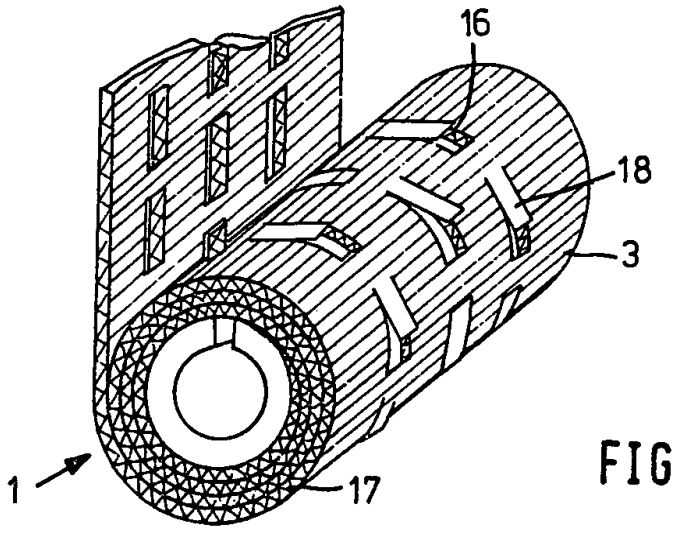

FIG.10

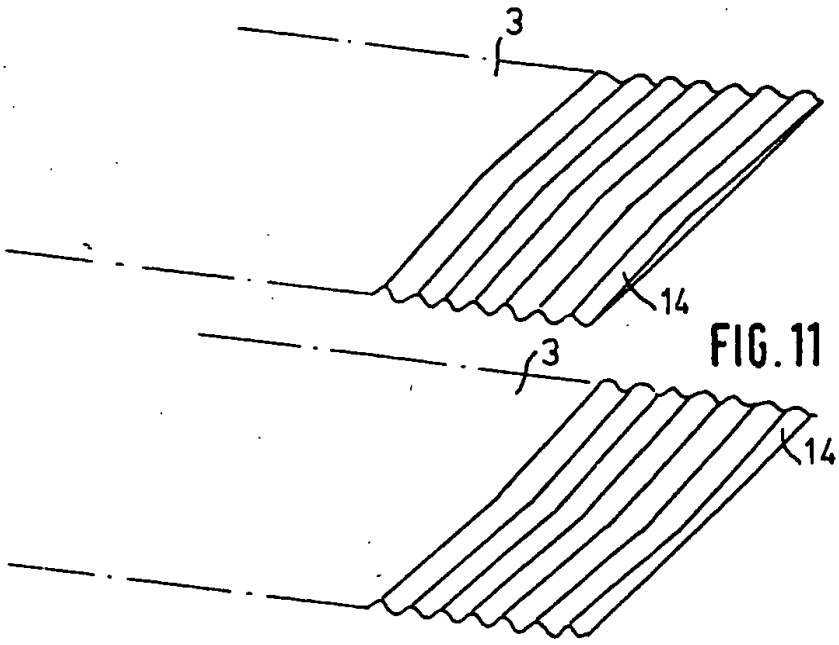

FIG.11

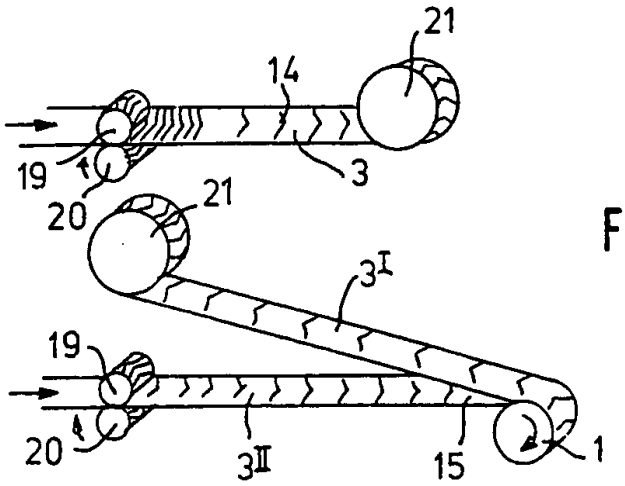

FIG.12

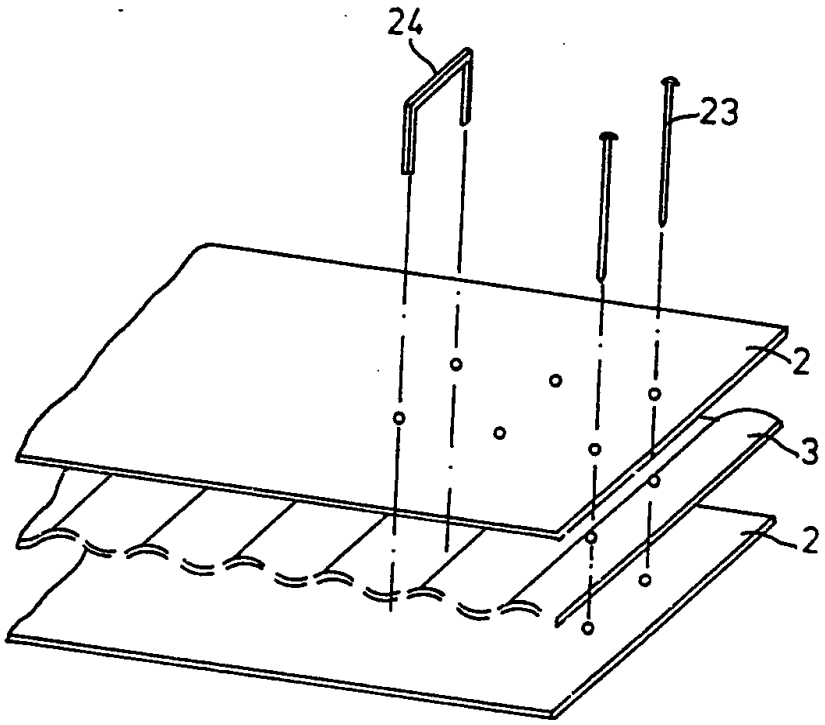

FIG. 13

the event of the nails or clips remaining in the matrix but also if, for example, the nails are removed.

Various embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:—

Figure 1 is an exploded view of a first embodiment of the invention;

Figure 2 shows an embodiment which is modified in relation to Figure 1;

Figure 3 shows an embodiment constituting a combination of the examples shown in Figures 2 and 3;

Figure 4 shows a further embodiment;

Figure 5 shows the embodiment according to Figure 4, partly in section;

Figure 6 shows yet a further embodiment;

Figure 7 shows a modified embodiment;

Figure 8 shows a further modified embodiment;

Figure 9 shows yet a further embodiment;

Figure 10 shows the matrix according to the embodiment in Figure 9 in the rolled together condition;

Figure 11 shows a modified embodiment;

Figure 12 is a diagram for producing the embodiment shown in Figure 11, and

Figure 13 is a further modified embodiment.

A matrix 1 according to the invention is generally produced from strips 2 and 3 of steel plate. In this respect, planar steel plates 2 alternate with superposed corrugated steel plates 3. In one form of matrix, a plurality of such plates are secured together and wound up to form a cylindrical wall. According to this embodiment of the invention, the planar steel plates 2 are provided with tangs 4*a*, 4*b*, some of which project upwardly and some downwardly from the plane of the steel plate 2. The corrugated steel plates 3 are provided with holes 5, preferably longitudinal slots. When the steel plates 2 and 3 are joined to produce a matrix, the projecting tangs 4*a*, 4*b* engage into holes 5 in the respective upper and lower adjacent layer. Stamping out the holes 5 and causing the tangs 4*a* and 4*b* to project can easily be carried out mechanically so that the individual winding layers of the steel plates 2 and 3 can be connected to one another without fixing means or welding operations, engagement of the tangs 4*a* and 4*b* into the holes 5 reliably preventing an axial displacement of the steel plates 2 in relation to the steel plates 3 (and vice versa). In the case of the example of embodiment according to Figure 1, the projecting tangs 4*a* point in the direction of the longitudinal axis of the steel plates 2, 3. The embodiment shown in Figure 2 differs materially from that in Figure 1 only in the orientation of the projecting tangs 4*a*. According to Figure 2, the tangs 4b, point at right-angles to the longitudinal axis of the steel plates 2. The tangs 4*b* are thereby disposed in lines and rows, the individual rows being possibly staggered in respect of one another. Accordingly, too, the longitudinal holes 5 in the steel plates 3 may be staggered in rows. In the case of the embodiments shown in Figures 1 and 2, the tangs 4*a*, 4*b* in one line are made to project in the same direction, while the tangs 4*a* or 4*b* on the next line project from the plane of the steel plate 2 in the opposite direction. However, the construction may be such that the alternating projection of the tangs 4*a*, 4*b* assumes a chess board pattern.

The example according to Figure 3 shows a construction which comprises upwardly and downwardly projecting tangs which are orientated both parallel with (4*a*) and also at right-angles to (4*b*) the longitudinal axis of the steel plates.

In the case of the embodiment according to Figure 4 (and Figure 5), the steel plates 2 are provided with tangs 6 which, when the steel plates 2 and 3 are wound to form a cylindrical matrix, are impressed into the steel plates 3. Figure 5 shows on an enlarged scale a detail illustrating the alternate projection of the tangs 6 on the strip of steel plate 2, so that they are impressed into the associated surfaces of the adjacent winding layers comprising steel plates 3.

A simplified embodiment is shown in Figure 6. In this, the steel plates 2 have marginal tangs 7 which may be angled for example on one side out of the plane of the steel plate 2. Preferably, however, the marginal tangs 7 are bent out of the plane of the steel plate 2 alternately upwardly and downwardly. In the case of this example of embodiment, the width of the steel plate 2 is slightly greater than the width of the steel plates 3, by approximately twice the height of the marginal tangs 7. As a result, the layers of steel plates 3 between the adjacent layers of steel plates 2 are held so that they are axially immovable by the marginal tangs 7 of the adjacent steel plates 2 resting against the edges 8 of the steel plates 3.

In the case of the embodiment shown in Figure 7, channels 9 are provided in the smooth strip 2 and impressions 10 forming channels are provided in the corrugated strip 3 of steel plate, whereby each channel 9 in the smooth strip 2 engages into an upper channel 10 in the corrugated strip while a bottom channel 10 in the corrugated strip 3 engages into the channel 9 in the smooth strip 2.

The embodiment shown in Figure 8 is a modified form of Figure 7, whereby the indentations producing the channels 10 in Figure 7, in the crest of the undulation in the corrugated steel plate 3 are replaced by arcuate segments 11. Furthermore, in the case of this embodiment, further such arcuate segments 12 are provided in the valleys in the corrugated steel plate, in a staggered location. Finally, the channels in the smooth steel plate 2 are located alternately upwardly 22 and downwardly 9, so that they can engage into the channels formed by the arcuate segments 11, 12.

In the case of the embodiment shown in Figure 9, only a corrugated type of sheet steel strip 3 is used. The corrugation is achieved substantially by transverse undulations 17. Bent out of the total thickness of the plates 3 are tangs 18 which, as can be seen in Figure 10, when the strips of steel plate 3 are rolled together, engage into holes 16 formed by the projection of the tangs 18. The direction of

the tangs 18 extends thereby parallel with the longitudinal axis of the steel plate 3. Also with this embodiment, lateral displacement of the individual winding layers with respect to one another and in an axial direction is effectively prevented.

Figure 11 shows a further embodiment of matrix 1 according to the invention with identically corrugated steel plates 3. The corrugation is provided thereby by a herring-bone pattern of undulations 14, whereby during assembly of a matrix, adjacent strips are in an opposite direction in relation to the herring-bone undulations 14. The friction between two superposed strips having inversely inclined undulations prevents an axial displacement of the layers. The oppositely directed arrangement of herring-bone undulations 14 forms cross-wise channels 15 which give rise to additional turbulence in flow.

Figure 12 shows how with the help of gear wheels 19, 20, a corrugated strip 3 according to the embodiment in Figure 11 can be produced from one smooth strip. Such a first corrugated strip is wound onto a supply bobbin 21 after which a second strip is provided with undulations 14 by means of gear wheels 19, 20 and from the supply spool 21, the first strip with the opposite herring-bone pattern is fed to the second strip, after which both strips are wound together jointly to form a matrix 1.

Figure 13 shows a further example of embodiment in which during or after winding of the steel plate strips 2 and 3, nails 23 or clips 24 are fitted and extend through several winding layers. Since the very introduction of the nails 23 or clips 24 gives rise to small jags in the steel plates 2, 3, any axial displacement of the steel plates 2, 3 is prevented and with this embodiment it is even possible to remove nails 23 again.

The invention is not limited to the examples illustrated and described. For instance, matrices may also be formed from planar steel plates 2 and 3 which are superposed to form a rectangular sandwich construction. The disposition and construction of the transverse undulations 17 according to Figure 9 may also be of a U-shape, in contrast to the embodiment shown.

Holes 5 in the corrugated steel plate 3 are holes preferably instead of the tangs 4 in the smooth steel plate 2 for producing turbulence are not confined to the examples of embodiment shown in Figures 1 to 3.

Although in the embodiments shown the corrugated sheets have conventional arcuate corrugations it will be appreciated that many forms of shaping may be used to provide the necessary spacing between the adjacent plates. For example, individual projections such as pimples may be provided instead.

CLAIMS

1. A carrier matrix for a catalytic reactor for cleaning exhaust gases of internal combustion engines including at least two superposed high temperature resistant steel plates coated with catalyst material, at least one of the plates being corrugated, and at least one plate being provided with raised portions and/or depressions, these raised portions or depressions interlocking with at least one adjacently disposed steel plate to prevent lateral movement between the plates.

2. A matrix according to Claim 1, wherein the raised portions take the form of tangs stamped out to project from the surface of the steel plate.

3. A matrix according to Claim 1 or 2, wherein the raised portions and/or depressions take the form of tangs projecting from the surface of the steel plate in the direction of a longitudinal axis of the steel plates and at right-angles to the direction of further tangs which project at right-angles to the direction of the longitudinal axis.

4. A matrix according to Claim 1, 2, or 3, wherein the adjacent steel plate (s) is (are) provided with holes into which the projections engage.

5. A matrix according to Claim 1, 2, or 3, wherein in a lamina plate, individual tangs, (preferably those which point at right-angles to the direction of the longitudinal axis of the steel plates) are omitted, their place being taken by holes or the lamina plate is left in its original state at these places, the holes still being present at or likewise omitted from the adjacent locations in the corrugated steel strip.

6. A matrix according to Claim 5 wherein said individual tangs point in a direction at right angles to the longitudinal axis of the plate.

7. A matrix according to Claim 2, wherein the tangs are made to project in such a way that when the plates are wound up to form a cylindrical roll, the tangs engage in an inner or outer layer of the winding.

8. A matrix according to Claim 2, wherein the tangs at the edge of a lamina plate project alternately upwards and downwards so that they laterally secure the respectively adjacent corrugated steel plates of the upper and lower layers.

9. A matrix according to Claim 1, wherein the raised portions or depressions are constructed as channels and the channel in a lamina plate engages into an upper channel in a corrugated plate while a lower channel of the corrugated plate engages into a channel in the lamina plate.

10. A matrix according to Claim 1, wherein the raised portions or depressions in the corrugated plate are constructed as arcuate segments into which adjacent channels in the lamina plate engage.

11. A matrix according to Claim 1, wherein the raised portions and/or depressions in both steel plates consist of a herring-bone pattern of undulations.

12. A matrix according to Claim 10, wherein the undulations in two adjacent steel plates are inversely inclined towards each other and form crosswise located channels.

13. A matrix according to Claim 1 or Claim 2, wherein the corrugated plate has transverse undulations and longitudinal tangs projecting and extending at right-angles to the transverse

undulations.

14. A matrix according to Claim 1, wherein adjacent steel plates are secured against axial displacement by nails or clips or by small jags formed in the steel plates by the nails or clips when these are driven into the plates, the nails or clips then remaining in the matrix or being removed after the jags have been formed.

15. A carrier matrix for a catalytic reactor for cleaning exhaust gases of internal combustion engines comprising a corrugated sheet, the corrugations of which are transverse undulations shaped so as to provide substantially planar opposed faces on the sheet, projecting tangs being formed in the sheet by being urged out of the plane of the sheet, the sheet being wound to form a cylindrical roll in such a way that the projecting tangs engage in depressions formed under tangs in an adjacent layer of the roll.

16. A carrier matrix for a catalytic reactor for cleaning exhaust gases of internal combustion engines substantially as described herein with reference to and as illustrated in Figure 1, 2, 3, 4 and 5, 6, 7, 8, 9 and 10, 11 and 12 or 13 of the accompanying drawings.

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